of the shoulder joint, and also various trophic disturbances. In this latter case differential diagnosis between syringomyelia and muscular atrophy had to be made.

Although all of these cases show departures from the classic type of the disease, they are of insufficient importance to be separated into different classes. They all belong pathologically to the same group of diseases. The lesions found post-mortem in cases one and six are probably the foundations of the changes found in all, viz.: the alterations in the large cells of the anterior horn. The etiological factor in the first location of the process is essentially overuse of the muscles. The lesions are not, however, confined to the anterior horns alone. In cases one and five the glosso-laryngeal involvement points to a bulbar process. There exists then a morbid series characterized by muscular progressive myelopathic atrophy, progressive labio-glosso-laryngeal paralysis and progressive nuclear ophthalmoplegia—three types of the same disease characterized pathologically by the same lesions of the nervous apparatus in different stages. Each can exist alone or develop by extension into one of the other types. They are essentially, however, the same disease. SCHWAB.

## ANATOMY AND PHYSIOLOGY.

55 STEHEN ALLE GANGLIENZELLEN MIT DEN BLUTGEFÄSSEN IN DIRECTER VERBINDUNG (Are All Ganglion Cells in Direct Connection with Blood vessels)? Albert Adamkiewicz (Neurol. Centralbl., 18, 1900, p. 2).

The author begins with the following hypothesis: Within the central nervous system the capillary circulation of the arteries belongs to the ganglia and is determined by their number and size.

From the standpoint of physiology he considers such hypothesis fully borne out, and argues thus: There is no organ whose function is not under the control of the nerves and no nerves which are not under the command of ganglion cells. The totality of organs makes up the body, the totality of nervous functions the body's life; hence, ganglion function is life. But life, as the supreme expression of material force, demands for its conservation the maximum quantum of the energizing fuel at the disposal of the body—that is, the nutritive elements or, in other words, blood. As A. did not believe that ganglion cells, not being simple tissue elements but independent organs of the most important and complicated sort, could derive their nutrition in the same elementary fashion as do connective tissue and muscle cells, namely, through a plasma stream which oozes from the finest capillaries of end arteries and makes its way through the tissues, he was led to search anatomically for a special and highly developed apparatus subserving this function.

56 Unfortunately for the complete verification of his theories his anatomical researches had to be limited, in the human, to a certain type of ganglion cells—those of the great intervertebral ganglia of the brachial plexus. These he found not to be bathed in a free plasma which reached them in the same diffused current that it did the other tissue elements. On the contrary they received their nutrient stream through the finest sort of vessels, which branched off from the arterial blood-capillaries and formed a sort of capillaries of the second order—vasa serosa—which gave passage to the fluid elements of the blood, but to none of the corporeal. One of these minute vessels would make its way to the ganglion cell, spread out and envelop the cell like a glove, narrow down on the further side into an outlet and then pursue

its course until it again entered an arterial blood capillary. From this inexhaustible nutrient gulf stream—its individual preserve, so to speak—the cell through its entire surface took as much energizing material as it needed for its work, and what it gave back in waste products collected in the vacuole of the so-called nucleus and made its way thence through the channel of the central veins of the ganglion back into the venous circulation.

What this stream means to the ganglion cells will be readily appreciated—the author tells us in a semi- "fairyland of science" aside—if we consider that they have an individual diameter of only some hundred-thousandths parts of a millimeter and that each is practically immersed in a stream which moves at the furious rate of 0.5 mm. per second, while other tissue elements are so intimately coherent that they offer only one surface to the languid plasma as it makes its snail-like way from arterial to venous capillaries.

For further and less particularized proof of his tenets Adamkiewicz has thus far been compelled to fall back upon physiologico-anatomical experimentation. By injecting the brain of a rabbit with carmine gelatin he found that the chief destination of the blood from the carotids was to the cerebral cortex, the manner of ultimate distribution being as follows: From the pial ramifications of the carotid numerous arterioles make their way into the cortex. These run (in a radiating fashion, quite close together) through the three ganglionic layers—the cortical, nuclear and intermediate layer—(elsewhere described by A.) and stop abruptly just at the boundary between the ganglionic storehouse, so to speak, and the projection layer. These arterioles give off lateral twigs which furnish the interlying ganglionic territory with a rich vascular network. The density of this network is not everywhere equal. The cortical layer (*Rindenschicht*—in A.'s nomenclature) is almost completely wanting in such network and of the other two the nuclear layer (*Kernschicht*), which is the richer in ganglia, is the more vascular.

In this circulatory peculiarity of the rabbit's brain A. sees strong support of his principles concerning the human species, *i. e.*, that the arterial flow to the central nervous organs is to the ganglion cells; and in proof of his proposition that also in the brain the arterial twigs stand in direct, though here not histologically demonstrable, connection with ganglion cells, he offers the following physiological argumentation: Every ganglion possesses a determinate function. If the ganglion is aroused, its function is awakened. If it is continuously irritated, prolonged and pathological functional activity ensues. Irritation of the ganglia of the cerebral cortex, for example, calls forth—as proof of its pathological activity—nystagmus, slowing of the heart's action and the respiration and tetanic spasm of the body muscles. All these phenomena, formerly falsely believed to be the result of "brain pressure," are, in the author's opinion, simply signs of protest on the part of corporeal organic functions under the control of the brain.

All unphysiological influences are a source of irritation for the ganglion substance as well as for nervous tissue. Even distilled water comes in this category, for if one denudes the brain of calvarium and membranes and allows distilled water to drop from a burette upon the denuded brain, the irrigation may be continued for hours without producing signs of cerebral irritation. One may even directly expose the ganglionic substance of the hemispheres to a forcible stream of water without resulting irritative phenomena, but if the same irritating agent—distilled water—is introduced into the brain through a carotid it requires only two or three centimeters to produce nystagmus, very marked disturbance of respiration and pulse and tetanic spasm in all the extensors of the body.

Adamkiewicz believes that this difference in the action of the same irritant can be explained only on the ground that when acting through the circulation it comes into more intimate relation with the ganglionic substance than in any other way, and that the logical conclusion from this is that the ganglia must lie within the arterial conduits and be completely immersed in blood.

His ultimate conclusions are as follows: All arteries which enter the brain and spinal cord of man and of animals—at least the higher—end on the yonside of the capillaries in minute plasma vessels, which contain the ganglia cells in diverticula. J. W. COURTNEY.

56 BEITRÄGE ZUR FEINEREN ANATOMIE DER GROSSHIRNRINDE (Contributions to the Finer Anatomy of the Cerebral Cortex). Hans Berger (Monatsschrift für Psychiatrie und Neurologie, Vol. 6, 1899, p. 405).

In an interesting article Berger reports the results of his study of the visual cortex of man. He examined: 1. The cortex of both calcarine fissures of a man sixty-five years old, who had lost the sight of both eyes twenty years previously on account of phthisis bulbi and detached retina, and had died from broncho-pneumonia without having shown evidence of mental disease. The brain of a woman of sixty-three years who had died from rupture of an aneurism of the aorta was used for comparison.

2. The cortex of both calcarine fissures of a woman of thirty-nine years who had been blind in the left eye for fourteen years. The brain of a woman of forty-four years who had died from typhoid fever was used for comparison.

3. The cortex of both calcarine fissures of a patient fifty years old with paretic dementia and complete optic atrophy of eight years' duration. The brain of a laborer of about the same age was used for comparison.

In these cases the optic atrophy was complete or bilateral. His statements are somewhat difficult to understand. In one place he seems to say that distinct variation from the normal was found only in the visual cortex of the man who had been blind for twenty years. Again, he states that in all his cases of blindness a distinct diminution of the cortical cells was seen; but further on he says that no distinct atrophy was found in the case of paretic dementia. In the brain of the woman with unilateral blindness the cells of the occipital cortex opposite to the blind eye were more atrophied than those in the occipital cortex of the same side. This atrophy of the cells of the visual cortex was regarded as similar to that which occurs in the cells of the anterior horns in hemiplegia. The atrophy of the cells extended throughout the cell layers of the visual cortex, and the cells especially concerned with the perception of light could not be distinguished. SPILLER.